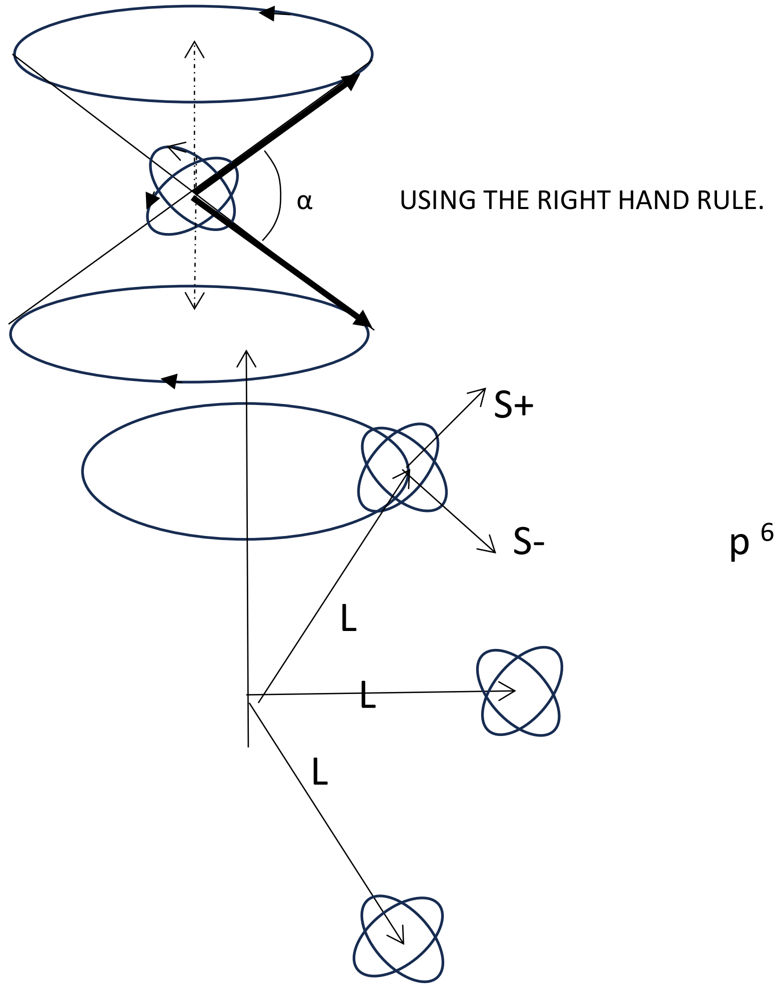
SPIN MOMENT:

are represented as S_x Yes S_z in 3-D.

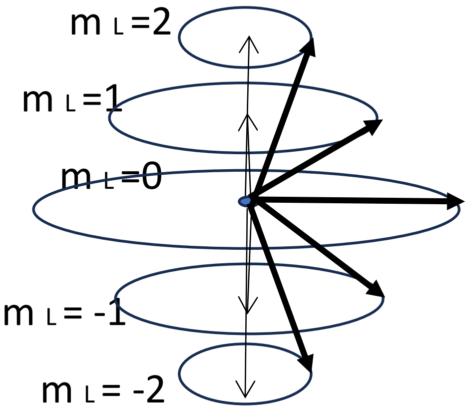


Knowing that when the number quantum prpal . n= 1 gives L = 1 and

m_L = -1, 0, 1 m_L = 2L+1

while the number quantum of spin : s= m_s = -½, +½.

We define j= L+ s. Since they represent levels of energy must be multiplied by Planck 's constant (minimum level of energy): ħ .



when L= 2 5 levels and 10 e^-

d^{10}

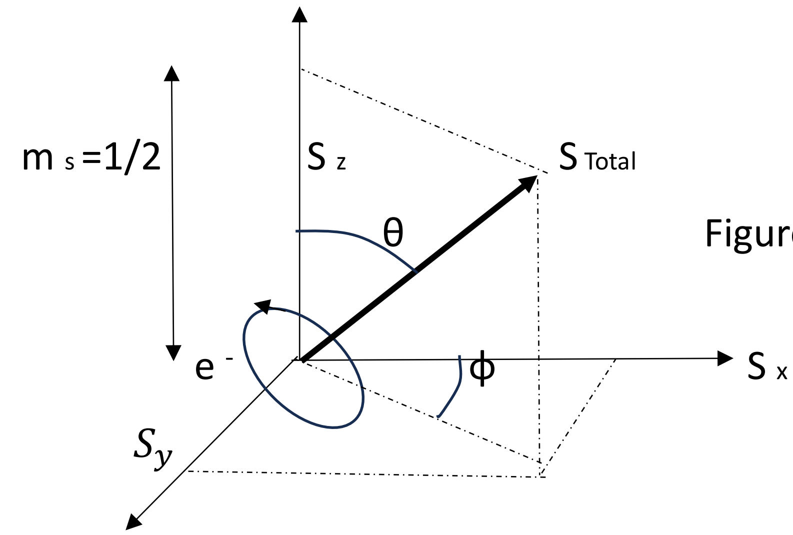
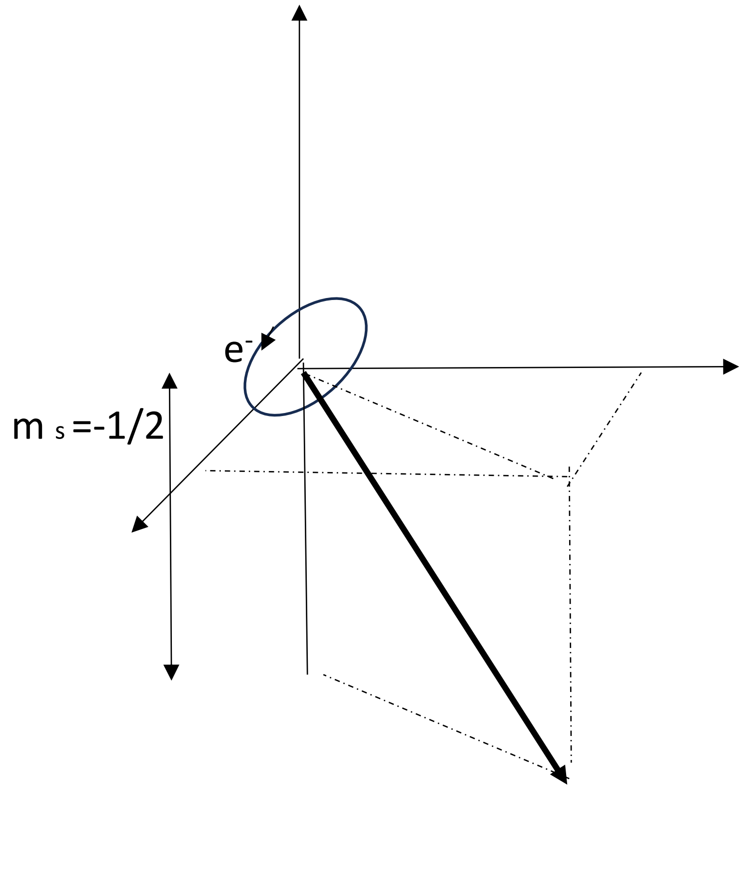
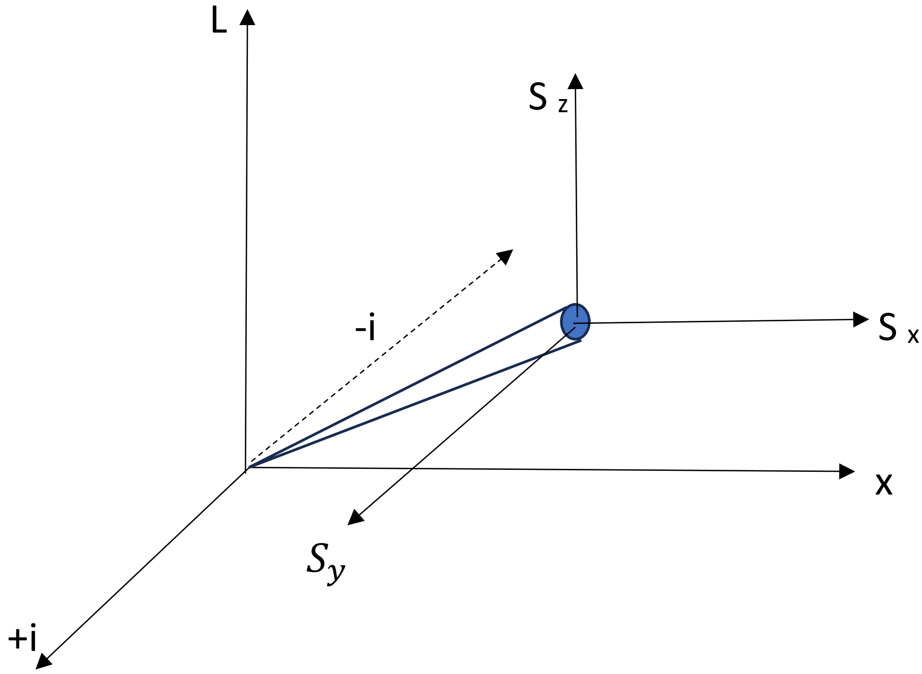


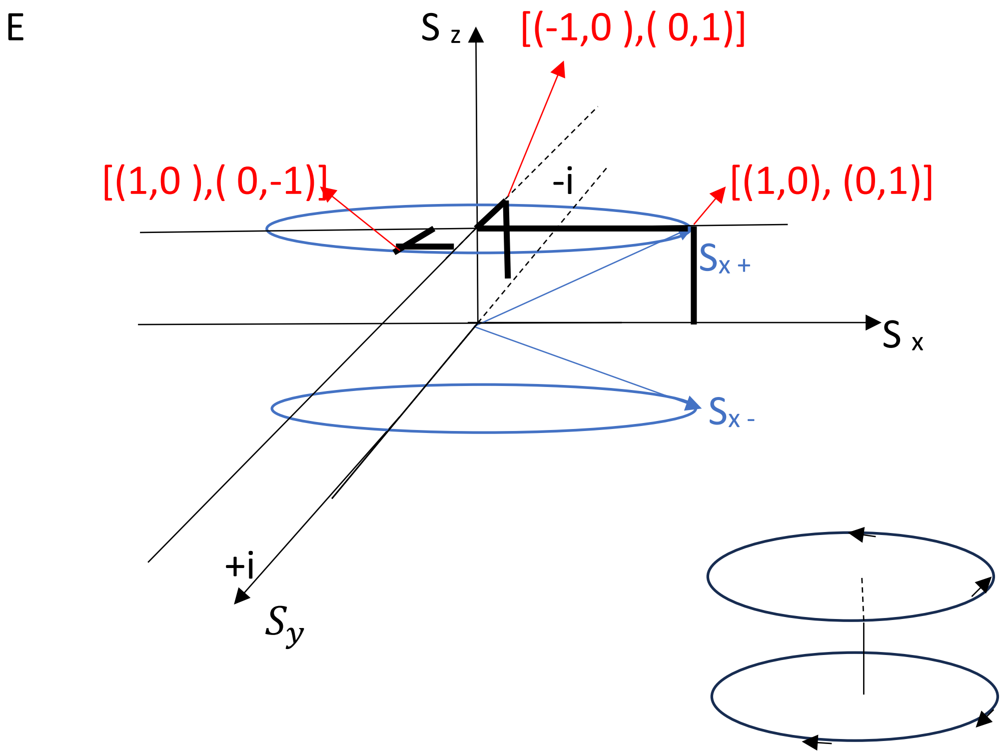
Figure 1



S_x, S_y and S_z are the components of S_{total}.

On the other hand:





So it is understood that $S_x = ½.(S_+ + S_-)$

while $S_y = i\ .\ ½.(S_+ - S_-)$

E= Energy (∝speed); contains values imaginary

(+ i , -i), understanding that the Energy can be 0 $< \quad o \quad >$0. According to Schrödinger:

-$\frac{ħ^2}{2m}.\nabla^2\Psi + \cdots \rightarrow$ i ^{2} . i = - i , while i ^{2} .-i= i

Deducing that S_x = ½.(S_+ + S_-) and S_y = i. $\frac{1}{2}$.(S_+ - S_-)

I guess S_+ and S_- no they have because have α= 90º.

You also need to have present that $\int_{-\infty}^{\infty}\Psi.\Psi^* dx = 1$= ($C_1.\Psi_1 + C_2.\Psi_2 + \cdots + C_n\Psi_n).(C_1^*.\Psi_1^* + C_2^*.\Psi_2^* + .. + C_n^*.\Psi_n^*)$=

= $C_1.C_1^* + C_2.C_2^* + \cdots + C_n.C_n^*$= 1 from which it follows that:

$$C_n = C_n^* = \frac{1}{\sqrt{n}}$$

We know that $S_x = \frac{ħ}{2}.\sigma_x$ $\quad S_y = \frac{ħ}{2}.\sigma_y$ $\quad S_z = \frac{ħ}{2}.\sigma_z$

since ħ is the minimum rated energy value, and $\frac{1}{2}$ is the number quantum spin also seen as a m_s.

$\sigma_x, \sigma_y, \sigma_z$: 2-D matrices:

$\sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ $\quad \sigma_y = i.\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ $\quad \sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

$\left| S_z, + \right> = \frac{ħ}{2}.\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$

And $\left| S_z, - \right> = \frac{ħ}{2}.\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} 0 \\ -1 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

and therefore : $\Big|$ S $_x$,+ >= $\frac{1}{\sqrt{2}}$. $\Big|$ S $_z$,+ > + $\frac{1}{\sqrt{2}}$. $\Big|$ S $_z$,- >

$\Big|$ S $_x$,- >= - $\frac{1}{\sqrt{2}}$. $\Big|$ S $_z$,+ > + $\frac{1}{\sqrt{2}}$. $\Big|$ S $_z$,- >

and: $\Big|$ Yes $_y$,+ >= $\frac{1}{\sqrt{2}}$. $\Big|$ S $_z$,+ > + $\frac{i}{\sqrt{2}}$. $\Big|$ S $_z$,- > (a)

$\Big|$ Yes $_{and}$,- >= $\frac{i}{\sqrt{2}}$. $\Big|$ S $_z$,+ > + $\frac{1}{\sqrt{2}}$. $\Big|$ S $_z$,- > (b)

Where we see that (a) and (b) are expressions that fit :

$\Big|$ Yes $_{and}$,+>= $\frac{\hbar}{2}.(\begin{matrix} 0 & -i \\ i & 0 \end{matrix}).\begin{pmatrix} 1 \\ 0 \end{pmatrix} = \frac{\hbar}{2}.\begin{pmatrix} 0 \\ i \end{pmatrix} = \frac{1}{\sqrt{2}}.\begin{pmatrix} 1 \\ 0 \end{pmatrix} + \frac{i}{\sqrt{2}}.\begin{pmatrix} 0 \\ 1 \end{pmatrix} =$

$=(\begin{matrix} \frac{1}{\sqrt{2}} \\ \frac{i}{\sqrt{2}} \end{matrix})$

$\Big|$ Yes $_{and}$,- >= $\frac{\hbar}{2}.(\begin{matrix} 0 & -i \\ i & 0 \end{matrix}).\begin{pmatrix} 0 \\ -1 \end{pmatrix} = \frac{\hbar}{2}.\begin{pmatrix} i \\ 0 \end{pmatrix} = \frac{i}{\sqrt{2}}.\begin{pmatrix} 1 \\ 0 \end{pmatrix} + \frac{1}{\sqrt{2}}.\begin{pmatrix} 0 \\ 1 \end{pmatrix} =$

$=(\begin{matrix} \frac{i}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{matrix})$